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Luke

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(54) **PROTECTIVE FLOOD BARRIER**

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(51) **Int. Cl.**
E02B 7/08 (2006.01)

(52) **U.S. Cl.** **405/114**; 405/115; 405/107

(58) **Field of Classification Search** 405/107, 405/114, 115, 116
See application file for complete search history.

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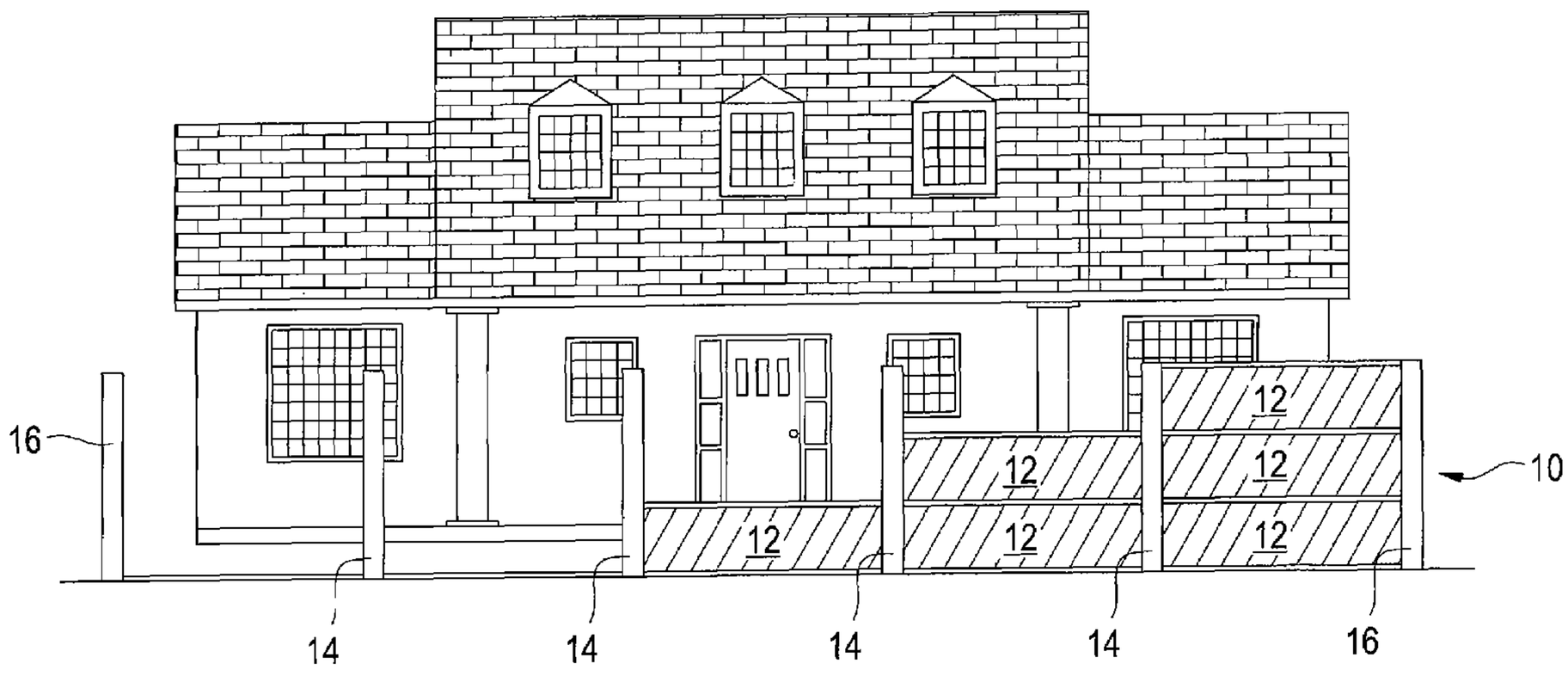
(57) **ABSTRACT**

A flood control system including panels made from plastic sheeting adhered to a frame and stacked one on top of the other. The panels are held in position by a series of columns, each of the columns having an H-shaped cross section that provides for and defines panel receiving slot adapted and arranged to interact with gaskets on the panels to provide a water tight barrier.

20 Claims, 8 Drawing Sheets



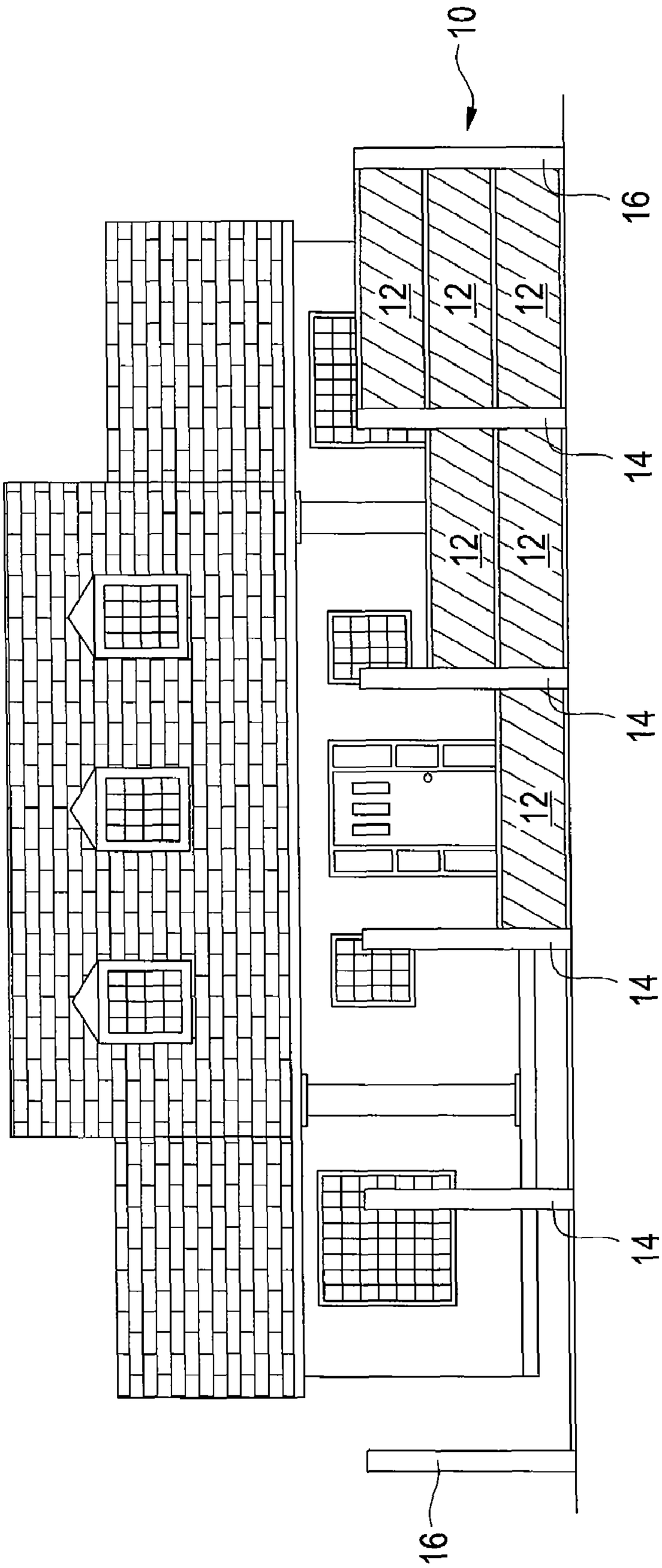


FIG. 1

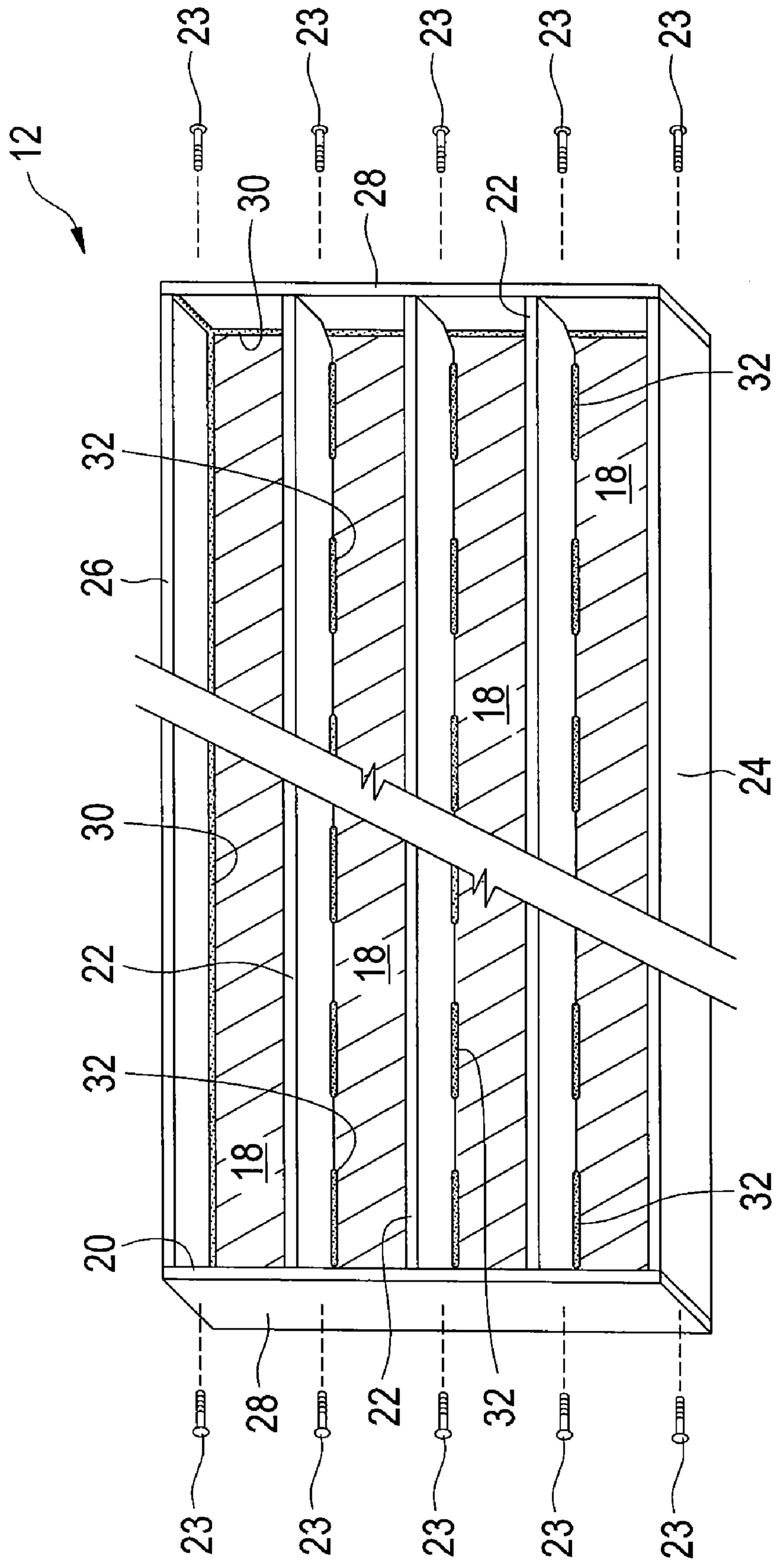


FIG. 2

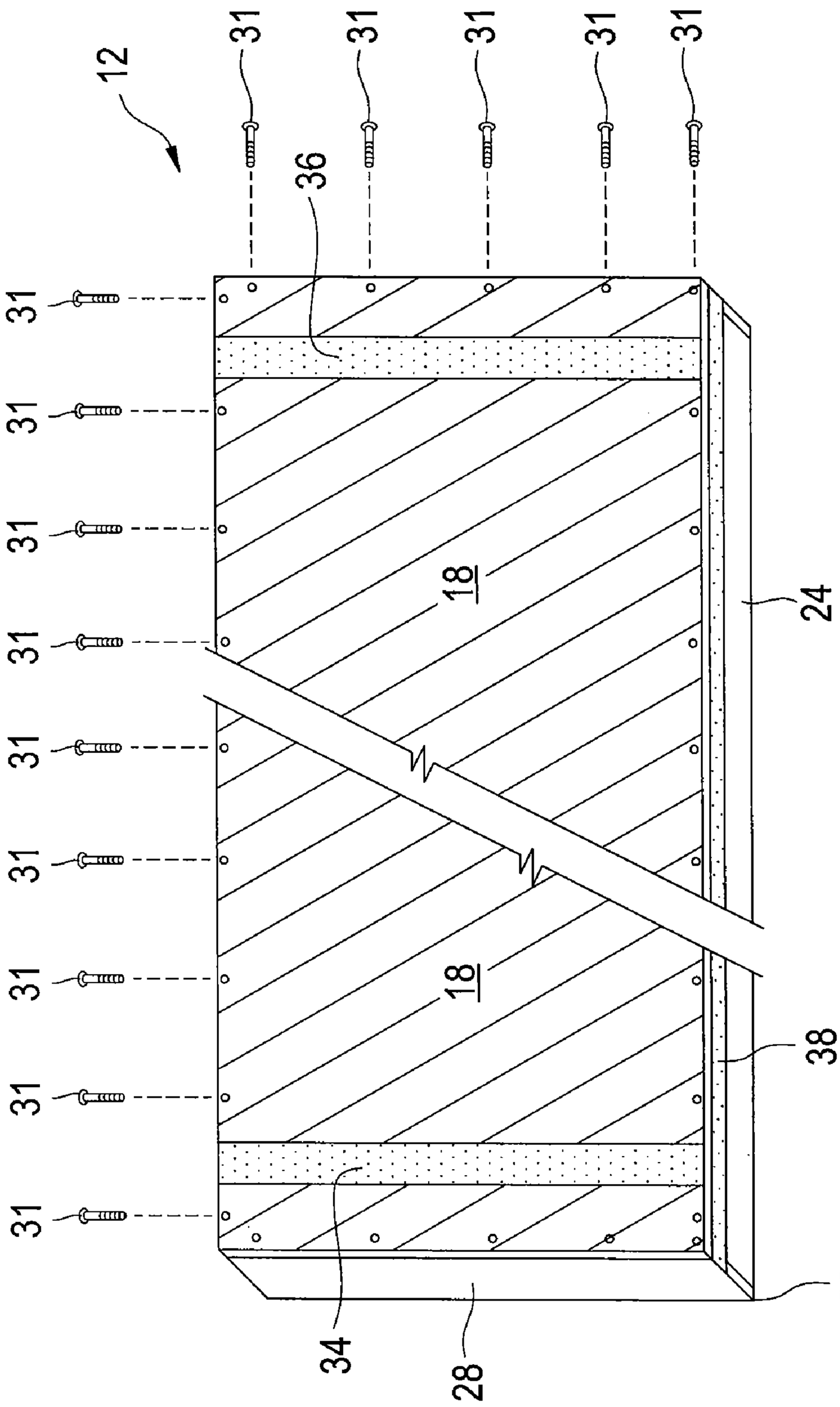


FIG. 3

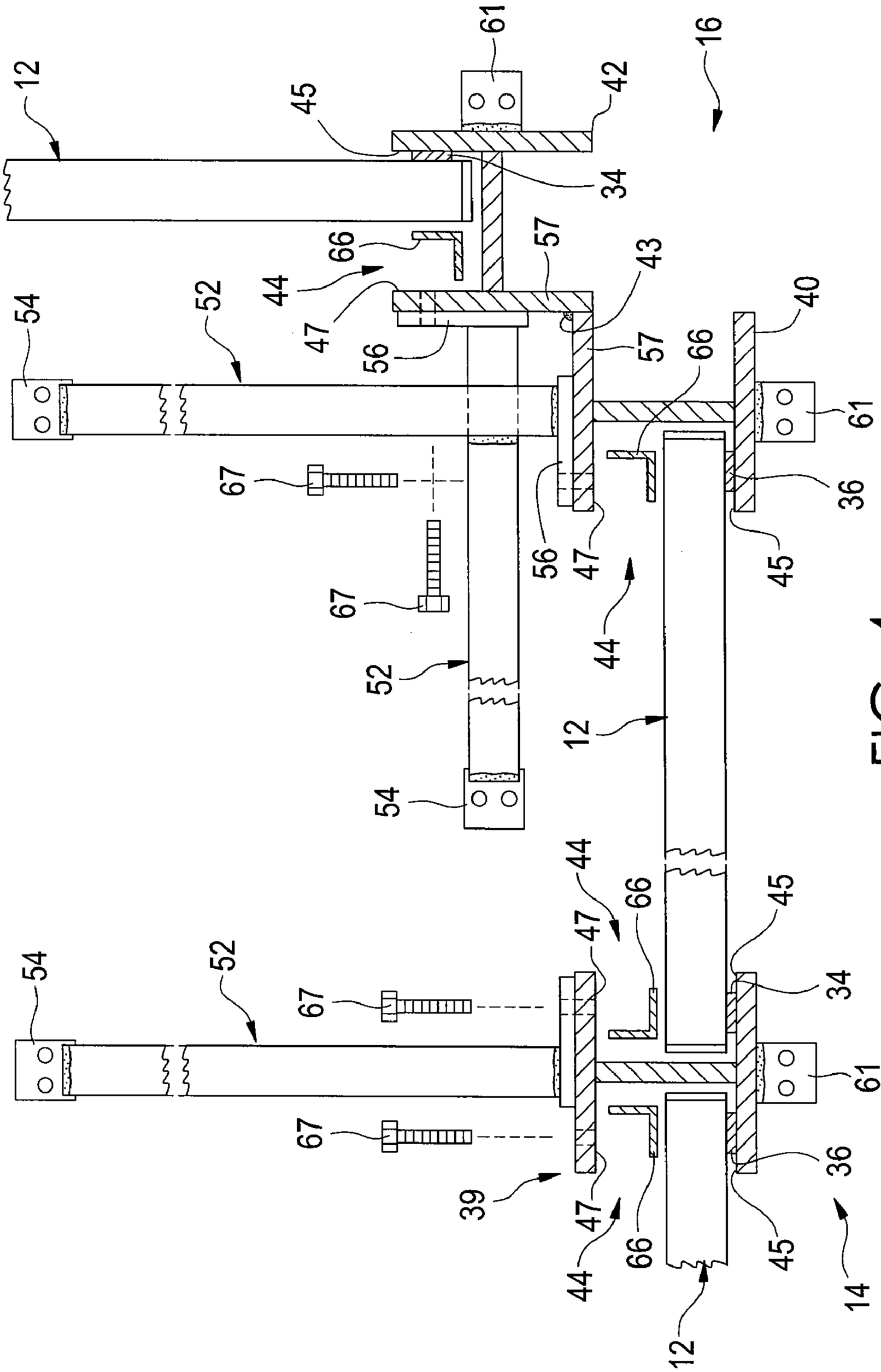


FIG. 4

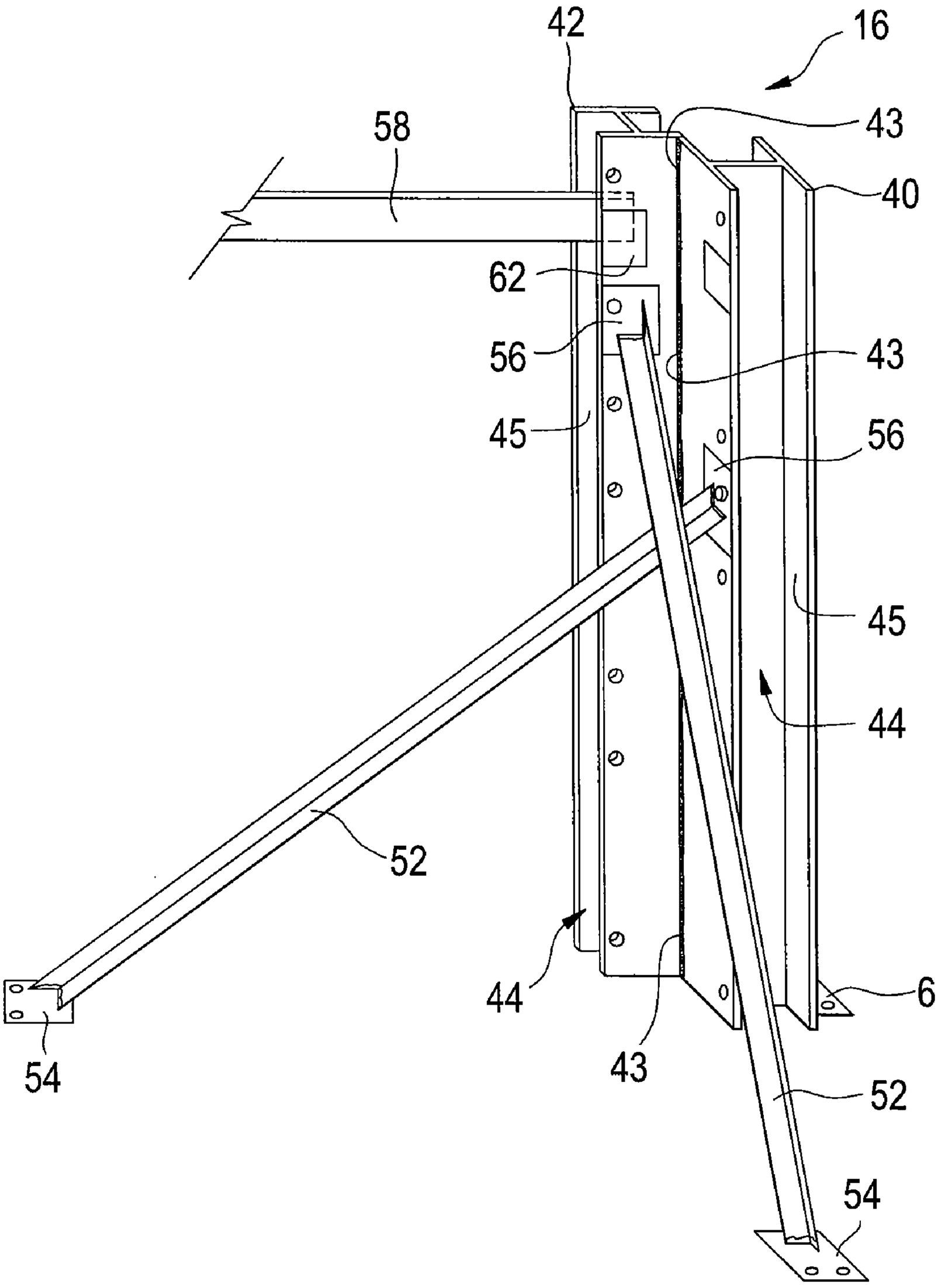


FIG. 5

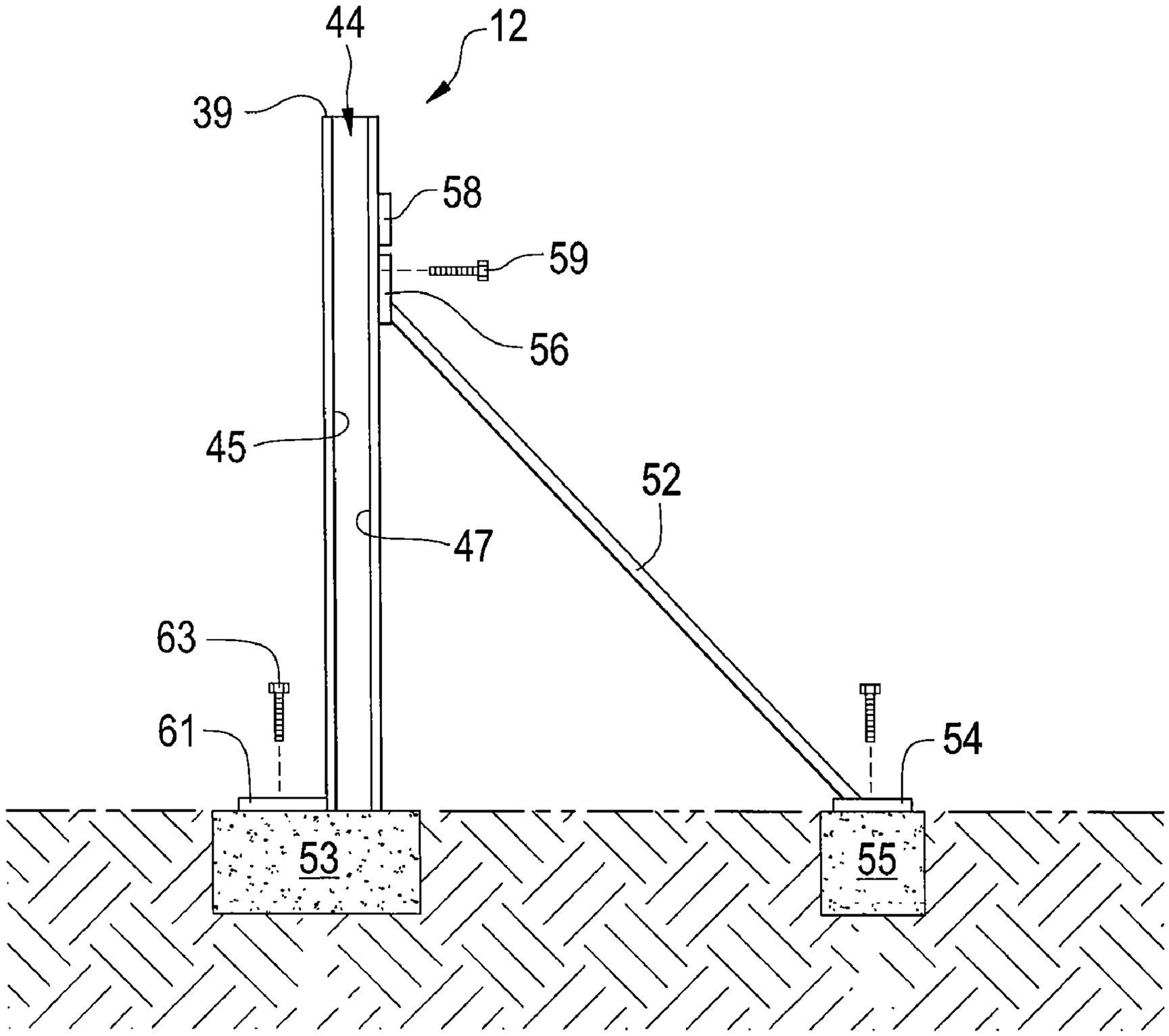


FIG. 6

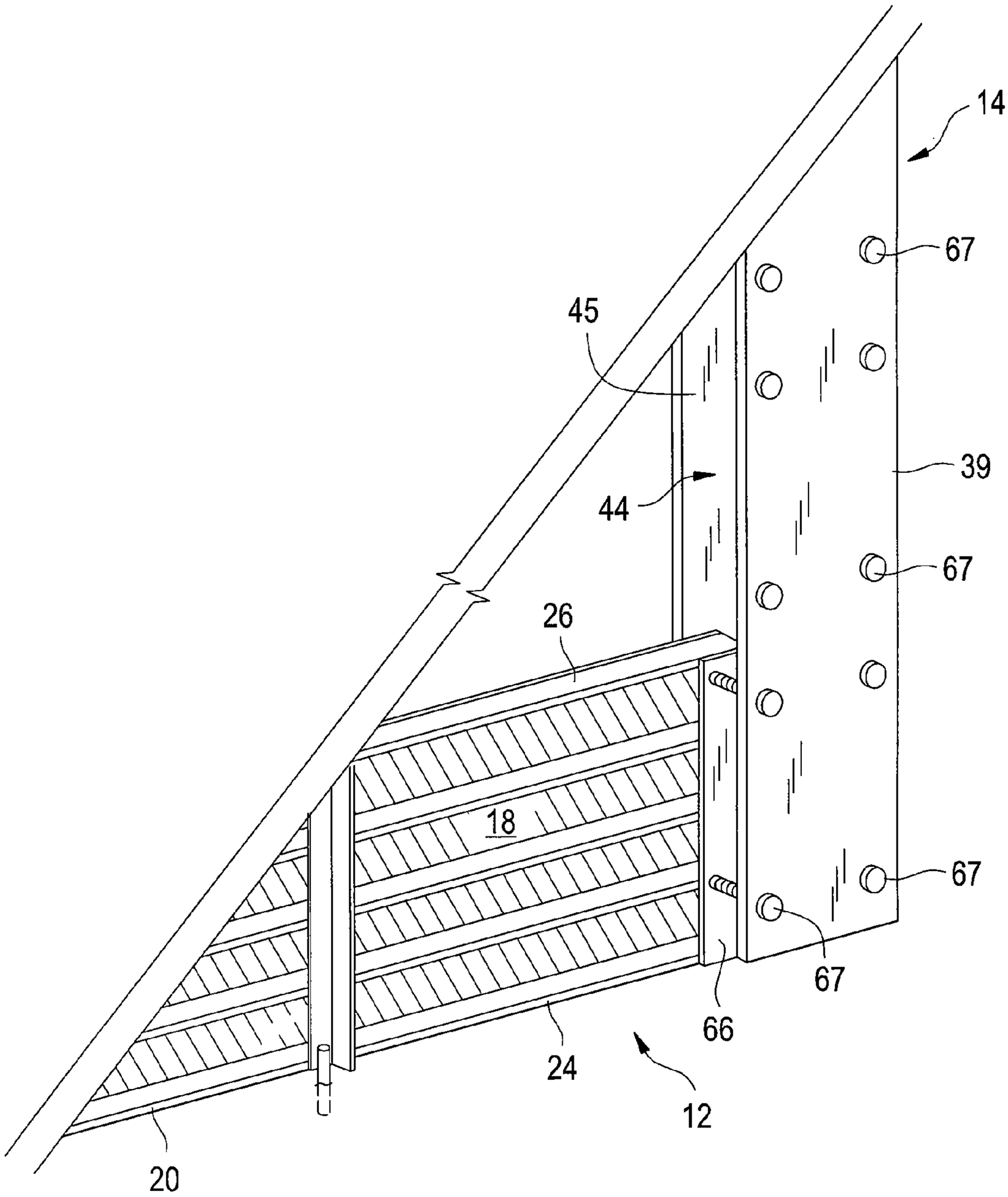


FIG. 7

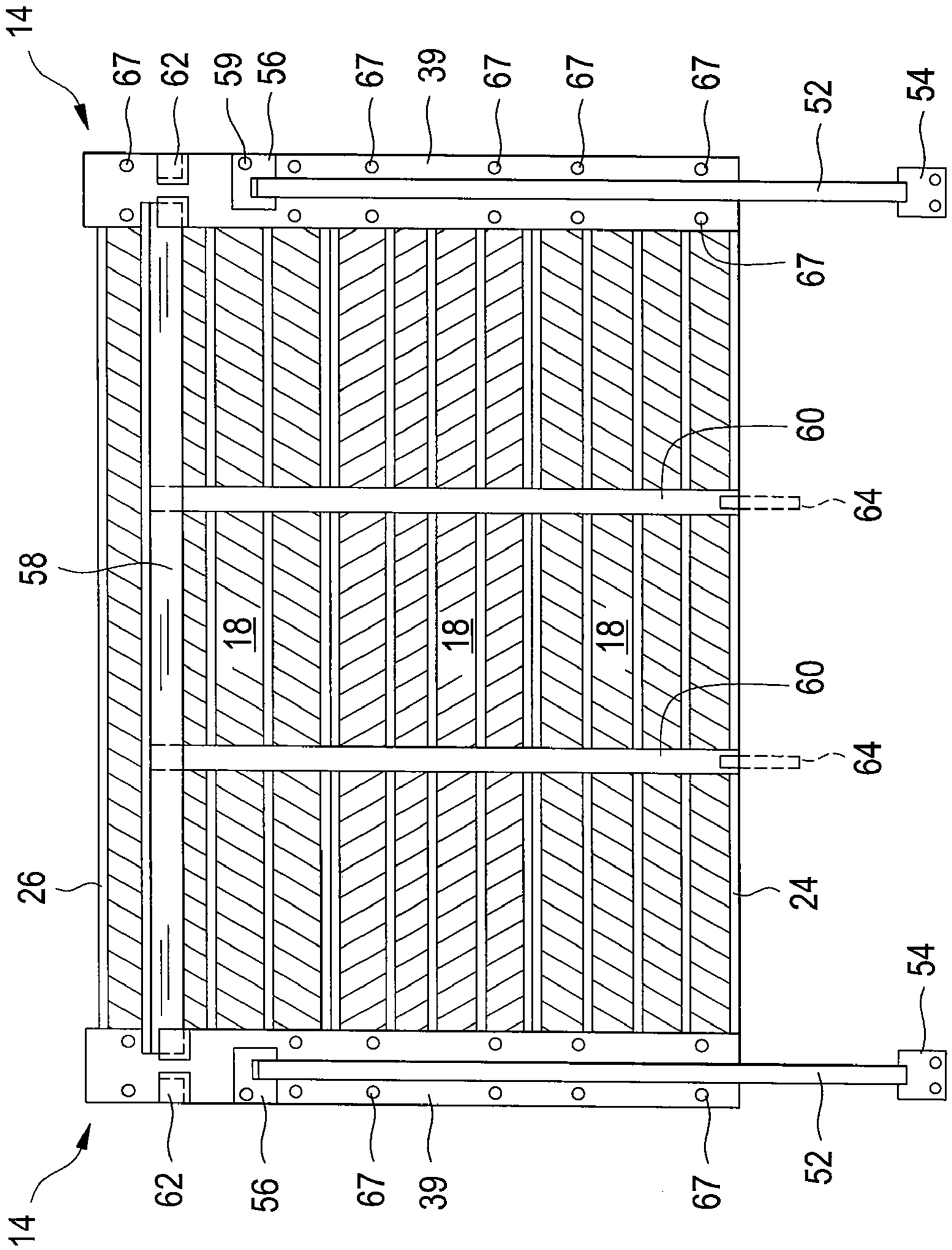

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FIG. 8

PROTECTIVE FLOOD BARRIER

FIELD OF THE INVENTION

The present invention generally relates to flood control systems and, more particularly, to a system of protective flood panels that can be arranged and maintained in place by columns to form a barrier against flood waters.

BACKGROUND OF THE INVENTION

With the advent of improved weather tracking and forecasting systems, flooding caused by rising rivers and streams, excess run-off and severe rain storms can now often be predicted hours or days in advance. This allows for precautions to be taken to protect structures such as houses and office buildings that are located in the path of a looming flood. For example, sandbags are sometimes placed around a structure to slow, but not altogether stop, the entry of water into a structure while pumps are provided for removing the water from within the ring of sandbags. Other times, valuables located within a structure are moved to higher elevations within the structure to minimize the overall damage caused by flood waters. However, if sufficient advance notice is provided more effective precautions can be taken such as erecting temporary dams or barriers around structures that are capable of preventing all water from passing therethrough. Thus, there is needed a temporary dam or barrier system that can be quickly erected around buildings for providing a barrier against flood waters.

SUMMARY OF THE INVENTION

The present invention is directed to a modular, prefabricated system of protective flood panels that can be arranged to form a barrier against flood waters. In one aspect of the invention, the barrier comprises a plurality of panels each prepared from a plastic sheet arranged on a frame to provide a substantially water-impermeable layer. The frame includes a top side, a bottom side, a pair of lateral sides and a plurality of reinforcement pieces connected to and between the pair of lateral sides. A first gasket is adhered to an exterior surface of the water-impermeable layer that extends between the top side and the bottom side adjacent to one of the pair of lateral sides. A second gasket is adhered to the exterior surface of the water-impermeable layer that extends parallel to the first gasket and adjacent to the other one of the pair of lateral sides. A third gasket is adhered to an exterior surface of the bottom side of the frame. A pair of columns, each of the columns having an H-shaped cross section is provided and anchored to a concrete foundation that surrounds the structure to be protected. The H-shaped cross-section forms in each a column a pair of oppositely facing panel receiving slot. In use, the panels are arranged one panel on top of another panel with the third gasket of each panel being brought into contact with either the concrete foundation or top side of another panel to provide a water impermeable seal therebetween. The panels are maintained in place by stacking them within and between the panel receiving slots of the pair of columns with the first gasket of each panel being pressed against the panel receiving slot of one of the pair of columns and the second gasket being pressed against the panel receiving slot of the other one of the pair of columns. This way, a water impermeable seal is created between the panels and the columns.

In further aspect of the invention, the barrier includes a plurality of the panels, a central column having an H-shaped cross section providing for a first panel receiving slot, and a corner column including a first elongate piece having an H-shaped cross section providing a second panel receiving slot and a second elongate piece connected directly to the first elongate piece and also having an H-shaped cross section providing a third panel receiving slot. In use, the panels are arranged one panel on top of another panel, as described above, and between the central column and the corner column with the first gasket of each of the panels being pressed against the first panel receiving slot and the second gasket of each portion of panels being pressed against the second panel receiving slot.

In yet another aspect of the invention, there is provided a method of protecting an area from flooding including providing a plurality of the panels, erecting a number of columns around the area to be protected, each column having an H-shaped cross section providing for oppositely facing panel receiving slots and arranging the panels one panel on top of another panel, as described above, and between the columns with the first gasket of each panel being pressed against the panel receiving slot of one column and the second gasket being pressed against the panel receiving slot of an adjacent column.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a plan view of the front side of a partially erected flood barrier system in accordance with the present invention.

FIG. **2** is a perspective view of the back side of an individual panel of the flood barrier system of FIG. **1**.

FIG. **3** is a perspective view of the front side of the panel of FIG. **2**.

FIG. **4** is a top plan view of columns and associated panel sections of the flood barrier system of FIG. **1**.

FIG. **5** is a perspective view of the back side of a corner column of the flood barrier system according to FIG. **1**.

FIG. **6** is a partial cross-sectional, lateral view of a middle column and middle column footing of the flood barrier system of FIG. **1**.

FIG. **7** is a perspective view of the back side of a middle column and associated panel of the flood barrier system according to FIG. **1**,

FIG. **8** is a plan view of the back side of two middle columns and associated panel section of the flood barrier system according to FIG. **1**.

DETAILED DESCRIPTION OF THE DRAWINGS

A flood barrier **10** in accordance with the presently preferred embodiment of the present invention is illustrated in FIGS. **1** through **8**, where like features of the invention share like numbering. As illustrated in FIG. **1**, barrier **10** generally includes a number of rectangular panels **12** stacked one on top of another and maintained in place by a network of columns including middle columns **14** and corner columns **16** located about a structure in danger of flooding. Panels **12** interact with the ground or any other surface on which barrier **10** is placed, columns **14** and **16** and each other to provide a water-impermeable wall around the structure.

Referring to FIG. **2**, each panel **12** is constructed of a relatively thin but rigid plastic sheeting **18** arranged and secured across a plastic, rectangular frame **20** to form a water impermeable panel surface. It is preferred that sheeting **18** has a thickness of not less than 0.125 inch, and more preferably, that sheeting **18** has a thickness of 0.187 inch.

Frame **20** consists of five horizontal reinforcing members each having a preferred length of 95 inches, including three interior members **22**, a bottom member **24** and a top member **26**, arranged in parallel and coupled to one another by a pair of vertical reinforcing members **28**, each having a preferred height of 24 inches and thickness of 0.5 inch and being connected to the respective ends of members **22**, **24** and **26** using screws **23**. The five horizontal reinforcing members are spaced between vertical reinforcing members **28** to provide four identically sized compartments on the backside or dry side of sheeting **18**. Plastic sheeting **18** is attached to frame **20** by arranging sheeting **18** across the horizontal members and forming a continuous plastic weld **30** between the periphery of sheeting **18** and bottom member **24**, top member **26** and vertical members **28**. It is important that continuous weld **30** be free from all defects that would allow the seepage of water between the sheeting **18** and frame **20**. A number of plastic spot welds **32** are also formed between sheeting **18** and interior members **22** to further secure sheeting **18** to frame **20**. Preferably, each of plastic spot welds **32** is approximately 4 inches in length and spaced 12 inches apart from adjacent spot welds **32** along the length of each interior member **22**. In addition, as illustrated in FIG. **3**, a number of screws **31** are used to strengthen the connection of sheeting **18** about its periphery to reinforcing members **24**, **26** and **28**. Preferably, screws **31** are placed 6 inches apart and 0.125 inch from the periphery of sheeting **18**. It is also preferred that screws **31** have beveled heads and be recessed below the surface of sheeting **18**.

Referring to FIG. **3**, a number of gaskets are secured to the front side or wet side of panels **12** in order to provide a water impermeable seal between panels **12**, when stacked one on top of another, and panels **12** and associated columns **14** or **16**, when panels **12** are positioned and supported therebetween, as illustrated in FIG. **1**. In particular, each panel **12** includes two gaskets **34** and **36** secured to the front side of sheeting **18** and a gasket **38** secured to the exterior or bottom surface of bottom member **24**. As illustrated, gasket **34** extends along the front surface of sheeting **18** and between bottom member **24** and top member **26** along the entire height of panel **12** and is arranged adjacent and parallel to one of vertical reinforcing members **28**. Similarly, gasket **36** extends along the front surface of sheeting **18** and between bottom member **24** and top member **26** along the entire height of panel **12** but is arranged adjacent and parallel to the other one of vertical reinforcing members **28**. Gasket **38**, on the other hand, extends along the entire length of bottom member **24**. Preferably, gaskets **34**, **36** and **38** are silicone sponge gaskets measuring 0.75 inches in width and 0.25 inch in thickness and having an acrylic adhesive backing to allow the gaskets to easily attach to sheeting **18** of panels **12** and bottom member **24**. It is also preferred that gaskets **34** and **36** are extended to contact and lie flush against gasket **38** in order to provide a seal therebetween.

Referring to FIG. **4**, each middle column **14** is comprised of a single beam **39** having an H-shaped cross-section, while each corner column **16** is comprised of two, connected beams **40** and **42**, each beam having an H-shaped cross-section. The rear walls or faces **57** of each of beams **40** and **42** are welded to one another at joint **43** along their respective lengths as illustrated in FIGS. **4** and **5**. In each instance, beams **39**, **40** and **42** have a length sufficient to allow columns **14** and **16** to be securely anchored with foundation **53** and extend therefrom at a ninety degree angle to a height sufficient to support panels **12** stacked to the height necessary to prevent flood waters from rising above barrier **10**. Preferably, beams **39**, **40** and **42** are conventional steel H-beams having a thickness of 3 inches between front surface **45** and rear surface **47**. The H-shaped cross-section of beams **39**, **40** and **42** define slots **44** along their entire lengths that are capable of receiving and securing an edge of one or more of panels **12** therein in a stacked manner. Specifically, beam **39** includes a pair of oppositely facing slots **44**, each slot **44** having a front surface **45** and a rear surface **47**. Beam **40** includes one slot **44** that opens in a direction perpendicular to a second slot **44** defined by the H-shaped cross-section of beam **42**. Slots **44** of beams **40** and **42** also include a front surface **45** and a rear surface **47**.

Columns **14** and **16** are spaced around a building to be protected at desired intervals, depending on the length of panels **12**. The columns are arranged along a continuous, pre-poured concrete foundation **53** having a width not less than 14 inches wide and a depth depending on the soil type in which foundation **53** is poured. With the desired length of panels being approximately 96 inches, it is preferred that columns **14** and **16** are spaced from adjacent columns by a distance of 96 inches. Each beam of columns **14** and **16** is connected with foundation **53** by means of respective anchor plates **61** that are welded to the bottom end of each of beams **39**, **40** and **42**. Two anchor bolts **63** are used to connect anchor plates **61** to foundation **53**.

Referring to FIGS. **4** through **6**, a number of braces are provided on the backside of columns **14** and **16** for strengthening the network of columns and maintaining them in position relative to the ground in which they are anchored and to one another. More particularly, there is provided a number of diagonal braces **52** for shoring up each individual one of beams **39**, **40** and **42**. Each diagonal brace **52** includes a first anchor plate **54** welded to the bottom end of brace **52** at an angle and arranged to connect with a concrete footing **55** embedded in the ground and a second anchor plate **56** welded to a top end of brace **52** at an angle and arranged to connect with the backside of one of respective beams **39**, **40** and **42**, by bolts **59**. Preferably, diagonal brace **52** is an angle iron measuring 2 inches by 2 inches and having a length of 78 inches and thickness of 0.125 inch. Additionally, there are provided a horizontal brace **58** and an associated pair of vertical braces **60** for each pair of adjacent columns. In particular, each horizontal brace **58** connects to and extends between the upper ends and back sides of two adjacent columns whether it be between two middle columns **14**, a middle column **14** and a corner column **16** or two corner columns **16**. More specifically, a pair of rectangular mounting tabs **62** are welded to the upper end of the back side of each middle column **14** and corner column **16** for receiving the ends of horizontal brace **58**. For middle columns **14**, pair of mounting tabs **62** are welded against each beam **39** in combination with one shim placed under the bottom side of each tab **62** and a second shim spaced under the interior, vertical side thereof to provide a pocket for receiving an end of horizontal brace **58** as illustrated, for example, in FIG. **8**. For corner columns **16**, one tab of pair of mounting tabs **62** is welded against each beam **40** and a second one of pair of tabs **62** is welded against each beam **42**. Like with middle columns **14**, the tabs **62** welded to corner columns **16** are welded in combination with one shim placed under the bottom side of each tab **62** and a second shim paced under the interior, vertical side thereof to provide a pocket for receiving an end of horizontal brace **58**. Preferably, each mounting tab **62**, measuring 1 inch in width, 1.5 inches in height and 0.25 inch in thickness, is welded against a respective beam using 0.375 inch shims to provide a pocket having a width of 0.375 inch. Further, it is preferred that each tab **62** is welded to its associated beam at a height of

63.5 inches above the surface of the ground in which the beam is anchored. To further support horizontal brace **58**, pair of vertical braces **60** are secured to and between a middle section of each horizontal brace **58** and foundation **53**. Each brace of pair of vertical braces **60** couples to both horizontal brace **58** and foundation **53** at a ninety degree angle. A pin **64** is used to connect each brace of pair of vertical braces **60** to foundation **53**. Preferably, each vertical brace is a 63.5 inch long, 2 inch by 2 inch by 0.25 angle iron, and each pin **64** is a round steel pin having a length of 6 inches and a diameter of 0.5 inch. Horizontal braces **58** and vertical braces **60** are provided in order to prevent flexing or bowing of panels **12**, which could compromise the seal formed by gaskets **34**, **36** and **38**.

In use, panels **12** are stacked within the network of columns comprised of middle columns **14** and corner columns **16**. When it is desired to place panels **12** in a substantially straight line, panels **12** are stacked between two middle columns **14**. Alternately, when it is desired that panels **12** be placed at right angles to one another, panels **12** are stacked between two columns including at least one corner column **16**. More particularly, once columns **14** and **16** of barrier **10** are erected and it is desired to shield a structure surrounded by the columns from flood waters, panels **12** are inserted between a set of adjacent columns and stacked to a desired height with gaskets **34** and **36** of stacked panels **12** being positioned within the opposing slots **44** of the respective columns. The interaction of gaskets **38** of the stacked panels **12** with the top members **26** of the stacked panels **12** forms a seal that prevents the movement of water therebetween. Likewise, to prevent the movement of water between the stacked panels **12** and the columns between which they are stacked, gaskets **34** and **36** of the stacked panels **12** are pressed against the front surfaces **45** of the slots **44** of the respective columns wherein they are positioned. The force necessary to produce a water-impermeable seal between the slots **44** and gaskets **34** and **36** of the stacked panels **12** is provide by placing a pressing member **66** between each of the stacked panels **12** and the rear surface **47** of each associated slot **44**. Preferably, pressing member **66** is a 1 inch by 1 inch by 0.125 angle iron having a length of 24 inches. As illustrated in FIGS. **4** and **7**, a pair of bolts **67** are threaded through rear surface **47** of the slots **44** and rotated to move forward against pressing member **66** causing pressing member **66**, in turn, to press against the panel **12** thus forcing one or more of gaskets **34** and **36** to press against the front surface **45** of slot **44** to form a seal therebetween. With water-impermeable seals created between the individual water-impermeable stacked panels **12**, the stacked panels **12** and foundation **53** and the stacked panels **12** and adjacent columns **14** or **16**, barrier **10** presents an apparatus that effectively walls off the protected structure from most sources of flood waters.

While the invention is described in connection with a specific embodiment thereof, it is to be clearly understood that this is done only by way of example, and not as a limitation to the scope of my invention, as set forth in the objects thereof and in the appended claims.

It is claimed:

1. A flood barrier comprising,

a plurality of panels, each panel including a water-impermeable sheet arranged on a frame to provide a substantially water-impermeable surface there across, the frame including a top side, a bottom side, a pair of lateral sides and a plurality of reinforcement pieces connected to and between the pair of lateral sides; a first gasket adhered to a front of the sheet and extending between the top side and the bottom side adjacent to one of the pair of lateral sides; a second gasket adhered to the front of the sheet and extending between the top side and the bottom side adjacent to the other one of the pair of lateral sides; a third gasket adhered to a bottom surface of the bottom side,

a first column having an essentially H-shaped cross-section and a first panel receiving slot defined by said cross-section, the first column being coupled to the ground,

a second column having an essentially H-shaped cross-section and a second panel receiving slot defined by said cross-section, the second column being coupled to the ground,

wherein the plurality of panels are stacked and arranged between the first column and the second column with the first gasket of each panel being pressed against the first panel receiving slot and the second gasket of each panel being pressed against the second panel receiving slot.

2. The flood barrier according to claim **1** further comprising a brace coupled to and between the ground and a rear side of the first column at a point within the upper two thirds of the first column.

3. The flood barrier according to claim **1** further comprising a horizontal brace connected to and between the first column and the second column and a pair of vertical braces coupled to and between the horizontal brace and the ground.

4. The flood barrier according to claim **3** wherein the pair of vertical braces extend parallel to and contact with one or more panels of the plurality of panels.

5. The flood barrier according to claim **1** further comprising a first pressing means for pressing the first gasket of one or more panels of the plurality of panels against the first panel receiving slot and a second pressing means for pressing the second gasket of one or more panels of the plurality of panels against the second panel receiving slot.

6. The flood barrier according to claim **5** wherein the first pressing means includes an elongate angled piece arranged within a space defined between the plurality of panels and the first panel receiving slot and a plurality of screw members arranged within a rear side of the first column for pressing the angled piece against the one or more panels of the plurality of panels when the screw members are turned.

7. The flood barrier according to claim **1** wherein the sheet and frame are plastic.

8. The flood barrier according to claim **1** wherein first column and the second column are coupled to the ground with a continuous, concrete foundation.

9. A flood barrier comprising:

a plurality of panels, each panel including a plastic sheet coupled to a frame to provide a substantially water-impermeable surface there across, the frame including a top side, a bottom side, a pair of lateral sides and a plurality of reinforcement pieces connected between the pair of lateral sides; a first gasket adhered to a front of the sheet and extending between the top side and the bottom side adjacent to one of the pair of lateral sides; a second gasket adhered to the front of the sheet and extending between the top side and the bottom side adjacent to the other one of the pair of lateral sides; a third gasket adhered to a bottom surface of the bottom side,

a first column having an essentially H-shaped cross-section and a first panel receiving slot, the first column being anchored to the ground,

a second column including a first elongate piece having an H-shaped cross-section and a second panel receiving slot and a second elongate piece connected along the length thereof directly to the first elongate piece and having an H-shaped cross-section and a third panel receiving slot,

wherein the plurality of panels are stacked and arranged between the first column and the second column with the first gasket of each panel being pressed against the first panel receiving slot and the second gasket of each panel being pressed against the second panel receiving slot.

10. The flood barrier according to claim **9** further comprising a first brace connected to and between an upper portion the first elongate piece and a first footing anchored within the ground and a second brace connected to and between an upper portion of the second elongate piece and a second footing anchored within the ground.

11. The flood barrier according to claim **10** wherein the first brace is connected with a rear side of the first elongate piece and the second brace is connected with a rear side of the second elongate piece.

12. The flood barrier according to claim **9** comprising another plurality of panels stacked and arranged within the third panel receiving slot.

13. The flood barrier according to claim **9** further comprising an angle iron adapted and arranged for pressing the second gasket of one or more panels of the plurality of panels against the second panel receiving slot.

14. The flood barrier of claim **13** wherein the angle is arranged within a space defined between the plurality of panels and the second panel receiving slot and a plurality of screw members are provided that are adapted and arranged to press the angle iron against the one or more panels of the plurality of panels when rotated within the first elongate piece.

15. A method of protecting an area from flooding comprising,

providing a plurality of panels, each panel including a water-impermeable sheet arranged on a frame to provide a substantially water-impermeable surface there across, the frame including a top side, a bottom side, a pair of lateral sides and a plurality of reinforcement pieces connected and between the pair of lateral sides; a first gasket adhered to a front of the sheet and extending between the top side and the bottom side adjacent to one of the pair of lateral sides; a second gasket adhered to the front of the sheet and extending between the top side and the bottom side adjacent to the other one of the pair of lateral sides; a third gasket adhered to a bottom surface of the bottom side, and

erecting a pair of columns outside of the area to be protected, each column having an H-shaped cross section and a panel receiving slot, and

stacking the plurality of panels one panel on top of another panel between the pair of columns with the first gasket of each panel being pressed against the panel receiving slot of one of the pair of columns and the second gasket being pressed against the panel receiving slot of the other one of the pair of columns.

16. The method according to claim **15** wherein each column of the pair of columns is anchored to the ground by a concrete foundation that extends between the pair of columns.

17. The method according to claim **16** further comprising connecting a horizontal brace to and between each of the pair of columns and connecting a pair of vertical braces to and between the horizontal brace and the foundation.

18. The method according to claim **15** further comprising pressing and holding the first gasket of one or more panels of the plurality of panels against the panel receiving slot of one of the pair of columns.

19. The method according to claim **15** further comprising

erecting a corner column including a first elongate piece having an H-shaped cross-section and a first panel receiving slot and a second elongate piece connected along its length directly to the first elongate piece and having an H-shaped cross-section, and

stacking another plurality of panels between the corner column and one of the pair of columns and within the first panel receiving slot.

20. The method according to claim **17** further comprising bracing at least one of the pair of columns against the ground with a diagonal brace.

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